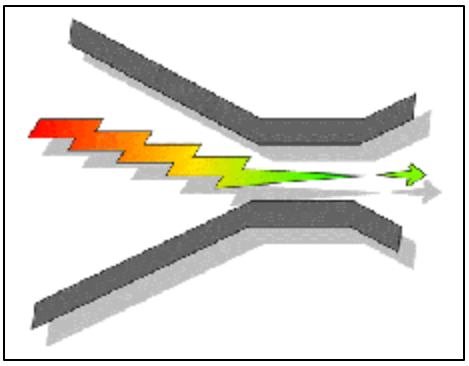
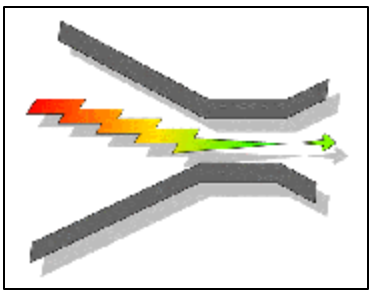


Overview of Pathways to Sustainability:

An Illustrated Introduction to the Environmental Management Strategy for Sustainability Developed for the Washington State Department of Ecology

Tools for Green Planning
Publication No. 02-01-007



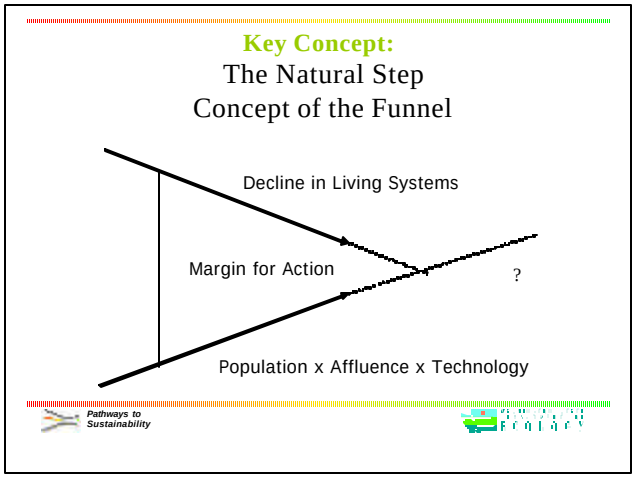
Overview of Pathways to Sustainability:

An Illustrated Introduction to the Environmental Management Strategy for Sustainability Developed for the Washington State Department of Ecology

Tools for Green Planning

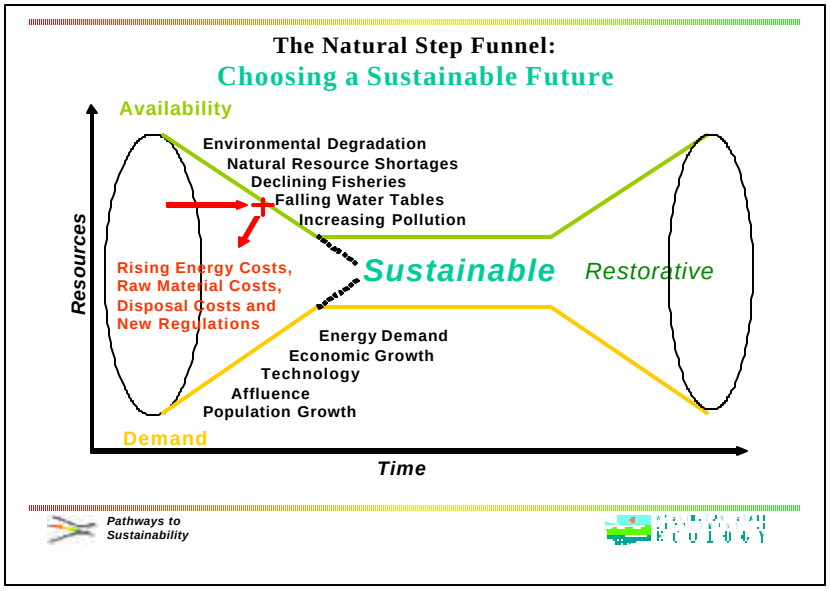
Key Concepts:

This project, despite its innovations, clearly builds upon the work of others in this emerging field of sustainability. The first key concept comes from the breakthrough green planning work done in Sweden, called "The Natural Step." What they call "the funnel" illustrates why we all need to act soon to reduce our environmental impacts to sustainable levels. The bottom line in this concept is a demand curve that rises over time, representing the increasing global demand for goods, services, and energy. This demand is driven by the combination of increasing population, increasing affluence and increasingly powerful technology.

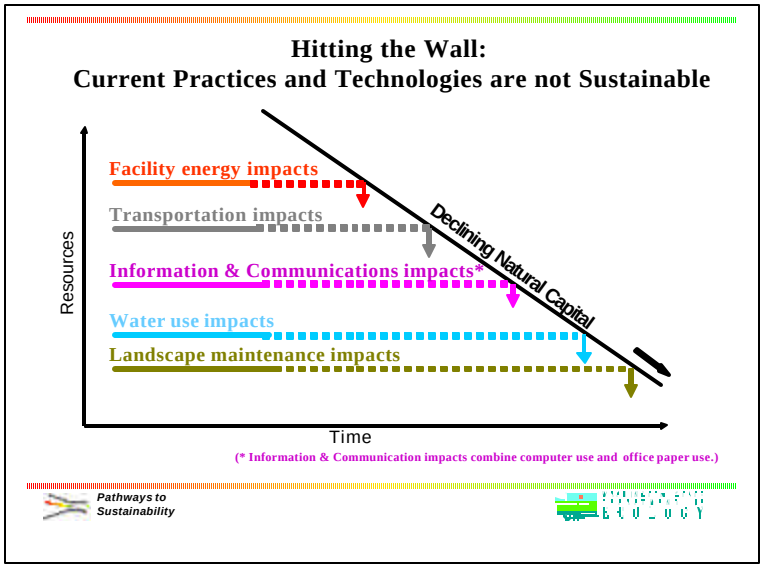


The flip side of this rising demand and consumption has been a corresponding decrease in natural resources, and in the vitality of living systems. Some level of natural resource use can be sustained for future generations. What level depends in part on population growth, over which we have little control. But it also depends on our technology, over which we have great control, and on the efficiency with which we use natural resources and energy. As Janine Benyus puts it in *Biomimicry*, it depends on how well our technology can work with natural systems (more at www.biomimicry.org).

As Paul Hawken, Amory Lovins, and L. Hunter Lovins describe in *Natural Capitalism*, the future contribution natural systems can make to human enterprise depends on how cleanly and efficiently we can use those natural resources. Our challenge is to flatten out our demand curve and the corresponding decline in natural systems. This is a global challenge. But it is also an enterprise-specific challenge. (*Natural Capitalism* is available at twbookmark.com)

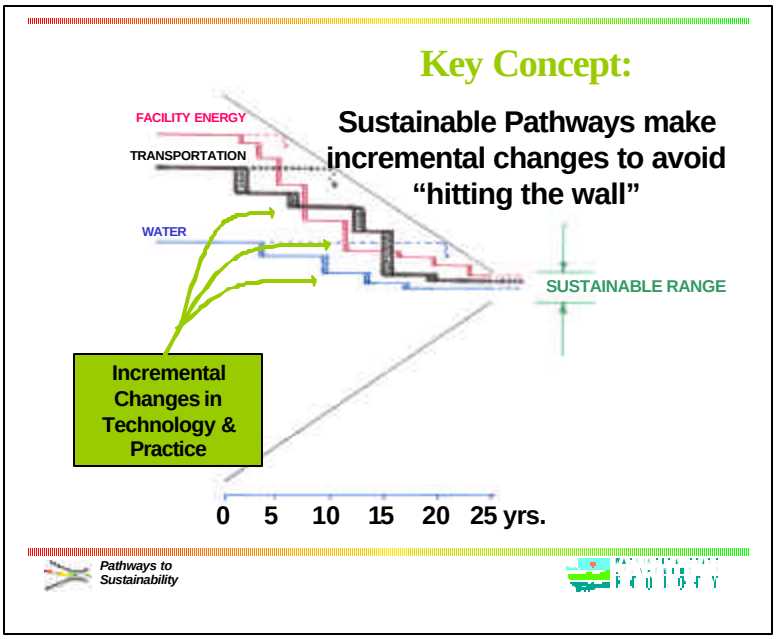


"Hitting the wall": Each enterprise -- whether business, public agency, or household -- currently has a level of product, resource and service use which more or less reflects mainstream consumption patterns. Typically, the levels of resource use required by today's technology and practice are not sustainable. Sooner or later, they will "hit the wall," jeopardizing the future of the enterprise. This wall takes the form of rising energy costs, rising raw material costs, rising disposal costs and, inevitably, legally



imposed limits and conditions on the use of scarce resources.

Finding pathways that avoid "hitting the wall:" Current consumption patterns can be changed. Over time, an enterprise can make changes in its practices and technologies. The idea is to make these changes toward sustainability before major disruptions are experienced. This is more apt to be successful, both for the enterprise and the larger society, if these changes can be planned in advance, and implemented in gradual steps. Some changes will require that emerging technologies come into large-scale production. Long-range planning can also be used to help exert a "pull" on the market for these alternative technologies.



Context and Approach:

The Department of Ecology set out several guidelines to ensure that good standards were applied to the consultants' research and development work, and to set the stage for successful implementation.

- **Build on existing systems:** Monitoring of existing impacts is accomplished primarily through existing tracking and reporting systems, to keep new reporting system costs and staff impacts low. Concentrating on those systems that actually receive high use would channel any reporting system investments into improving core management information systems, and avoid unproductive investments in systems that would not be used.

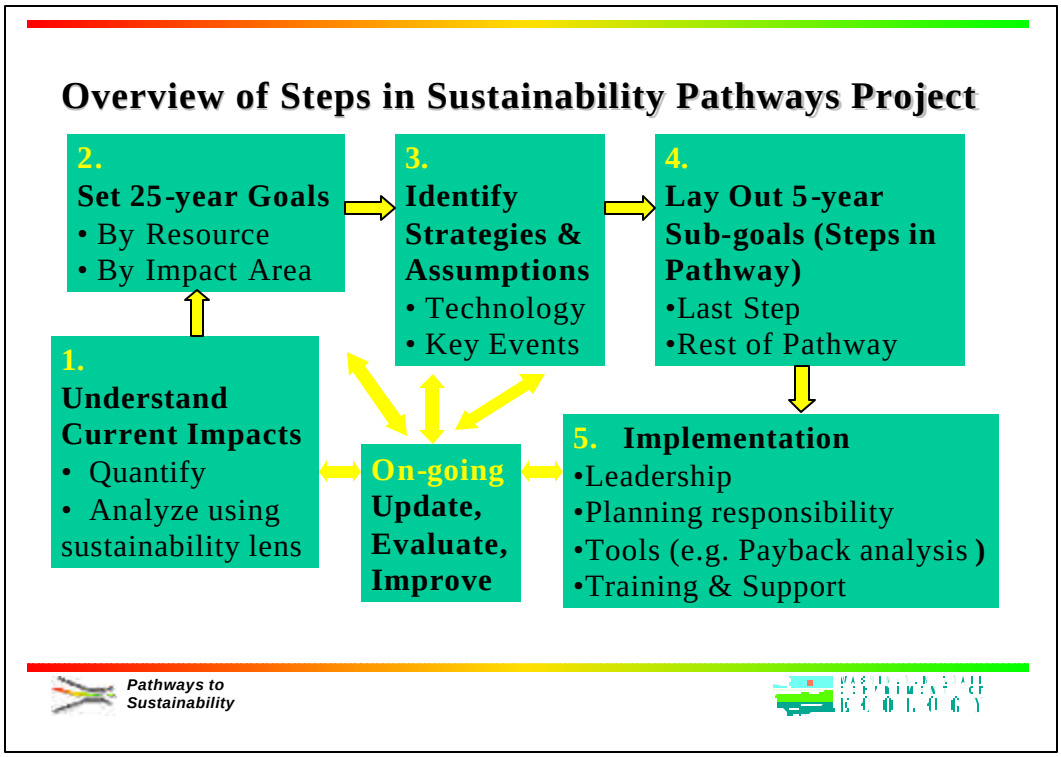
- **Reveal priorities for action:** Existing impacts have to be analyzed from a sustainability perspective, to help concentrate limited resources for investments in change where there is the greatest concern.

- **Build an open green planning model:** A planning framework had to be devised that could be applied (and demonstrated) by the Department of Ecology, and could easily and quickly be extended to other Washington State agencies as requested. The approach used also had to be broad enough that it could be adapted for use by other agencies, businesses and households.

- **Support the goal of becoming sustainable in 25 years:** This planning framework had to support the goal of achieving sustainability in 25 years. This time frame is appropriate to the scale of change that needs to be made, and is consistent with other major green planning models.

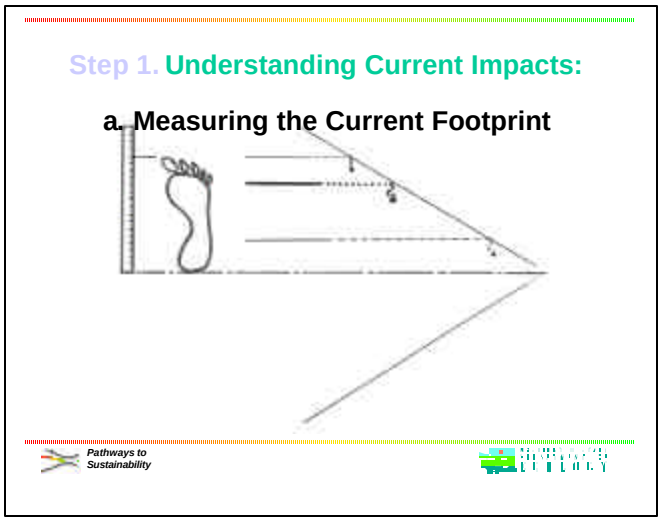
- **Support implementation with a payback calculator:** Implementation of the planning framework needs to be supported by decision support procedures and tools that can help calculate the avoided costs of future gasoline and electricity consumption at higher prices.

Overview of the Pathways Model: five basic steps to adopting Pathways to Sustainability.



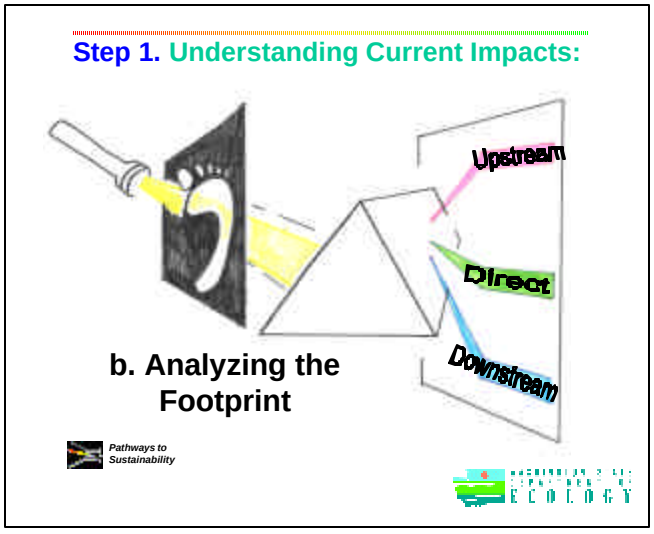
1. **Understand Current Impacts:** Understanding current impacts has two parts: quantifying energy, materials, and resources used; and analyzing the results from a sustainability perspective to see which are of most concern.

- **Existing management reports** were used wherever possible as the basis for quantifying current impacts. For impacts with seasonal fluctuations, a full year's data was required, but either calendar year or fiscal year data was acceptable. Where existing reports lumped together two or more things that should be analyzed separately, percentage breakouts of the annual totals were estimated based on a sample where data was available. Implementation teams will revisit their data requirements later, and recommend some specific improvements in data collection and reporting, where necessary.



- **Analyze the impact data from a sustainability perspective:** The Pathways model uses computer-based models from environmental economics to quantify relative impacts from a sustainability perspective. What distinguishes these models (and establishes the sustainability perspective) is their inclusion of "upstream," current and "downstream" impacts.

  These econometric models help identify and weigh impacts, and use a cost index to compare relative impacts from a sustainability perspective. They have three parts:



1) **Life Cycle Inventory (LCI):** a listing of the inputs and outputs which occur in the origin, use, and eventual fate of a product or service;
2) **Life Cycle Assessment (LCA):** An analysis and quantification of a product's environmental impacts identified in the LCI: and
3) **Economic Valuation (EV):** a computation of the economic costs of a product's environmental impacts. Used here to calculate relative impacts.

To simplify the impact assessment at the Department of Ecology, impacts were measured at the agency's largest facility, its Headquarters/Southwest Regional Office facility in Lacey. For overall planning purposes, these relative impacts are representative of the agency's statewide impacts. (During implementation, the variations among different facilities will have to be taken into account in specific proposals.) Ecology's biggest impacts at its Lacey facility were:

- Facility energy consumption;
- Transportation impacts;
- Computer impacts and paper consumption.

The next tier of impacts were:

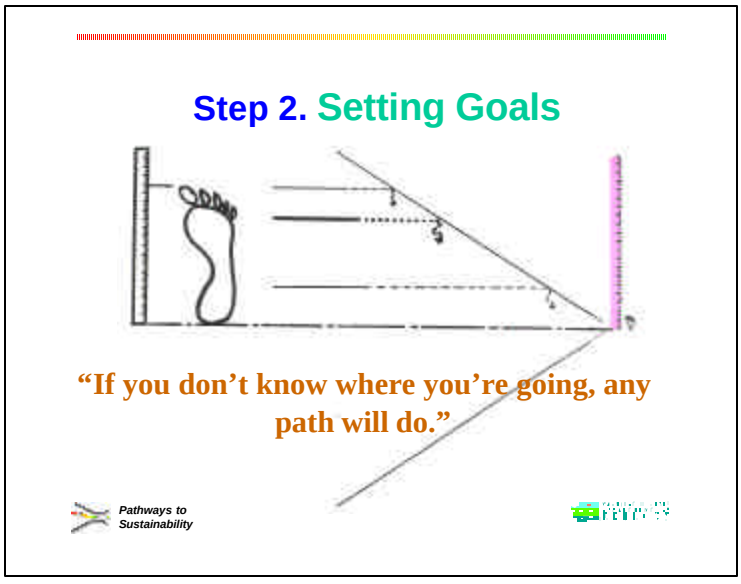
- Water use;
- Landscape maintenance impacts.

Not yet studied were:

- Food service impacts.

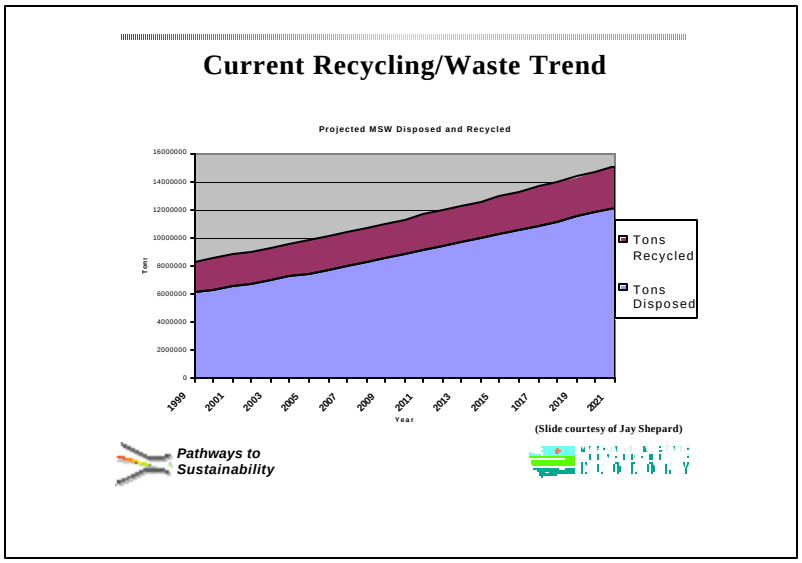
(The last three areas are of particular interest, since they round out the major concerns for the typical household's sustainability.)

2. Setting Goals: The next step is to set goals. The general goal is: "We will be sustainable in 25 years." The 25-year planning horizon is consistent with the Oregon Executive Order, and seems appropriate to the scale of change we are making. While 25 may be somewhat arbitrary (and could be changed in the future in response to unforeseen changes in conditions), it strikes a good balance between allowing time for new technologies to come on line, and requiring that implementation begin soon.



The importance of setting the goal for sustainability, as a commitment, cannot be overstated. There is a profound difference between moving toward sustainability

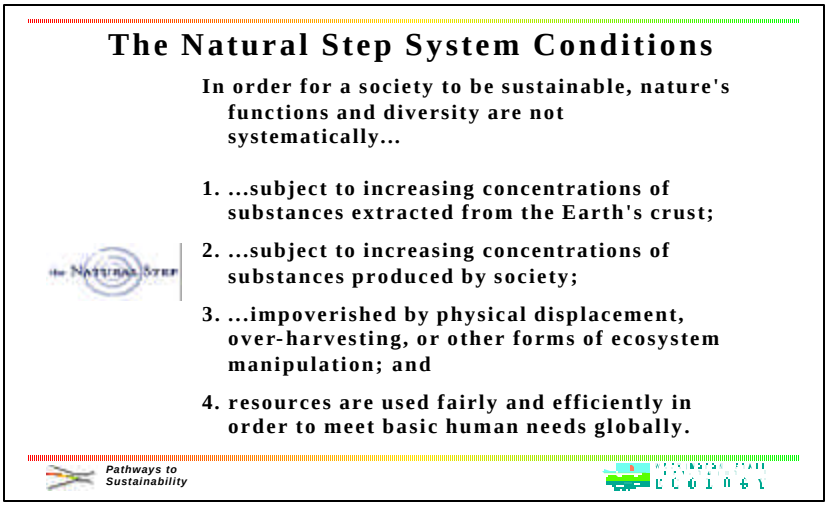
as opportunities arise, and adopting a long-term goal and strategy of achieving sustainability in 25 years.



Current recycling and waste management trends in Washington State illustrate this problem. (Thanks to Jay Shepard of Ecology's Solid Waste Financial Assistance Program for this slide.)

This slide shows the trend that recycling in Washington State (represented by the dark band) is projected to increase over time. However. the trend for waste generation (represented by the growing field under the recycling band) is projected to grow even faster (unless some more fundamental changes are made). It shows that we can increase recycling year by year, but get further and further from sustainability.

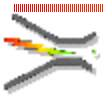
In the Pathways to Sustainability model, our goal-setting process began with the setting of specific 25-year goals for each of the impact areas identified in Step 1. The "compass" from the Natural Step was used to help set goals systematically, as illustrated above for the Energy Pathway. The Natural Step defines four system



conditions that must be met to achieve sustainability. These system conditions were chosen for goal setting because they offer a good, science-based definition of sustainability. To augment system conditions three and four for the goal setting process, two additional criteria were added: Natural Capital and Human Capital.

Expanded Goals Matrix Used in Developing Resource and Functional Pathways

TNS System Condition #1	**TNS System Condition #2**	**TNS System Condition #3**	**Natural Capital**	**TNS System Condition #4**	**Human Capital**
Extraction from the earth's crust	Human-made substances	Productive capacity of nature	Ecosystem assets and productivity	Equity, human needs, and efficiency	Human resources, skills, and productivity



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These last two categories were often useful when a group of consultants and staff were in a goal-setting work session, since some participants found these concepts more "user-friendly" than their Natural Step counterparts. Later, the goal statements were refined into the four Natural Step categories.

Below is an excerpt from the Energy pathway. The complete goal statements for each pathway are available in the report. (Other agencies or organizations may want to use these goal statements as a point of departure, and modify them as needed to fit their own impacts, rather than work through them from scratch.)

Sustainability Goals (Energy Pathway Example)

Resource	TNS System Condition #1	TNS System Condition #2	TNS System Condition #3	TNS System Condition #4
Energy	• **Energy is from 100% renewable sources**	• Zero release of toxics used in energy systems. (i.e. materials in fuel cells)	• Non-polluting generation • Energy sources are non-polluting and non-toxic to living systems • No net carbon is released to the atmosphere through the energy production or consumption • Transmission infrastructure is non-polluting and non-toxic to living systems	• On-site generation is used where practical • Zero Waste of energy use on-site • On-site energy budget is efficiently allotted among facility needs and other energy subsystems

The final stage of the goal setting process is to envision how these goals would be met.

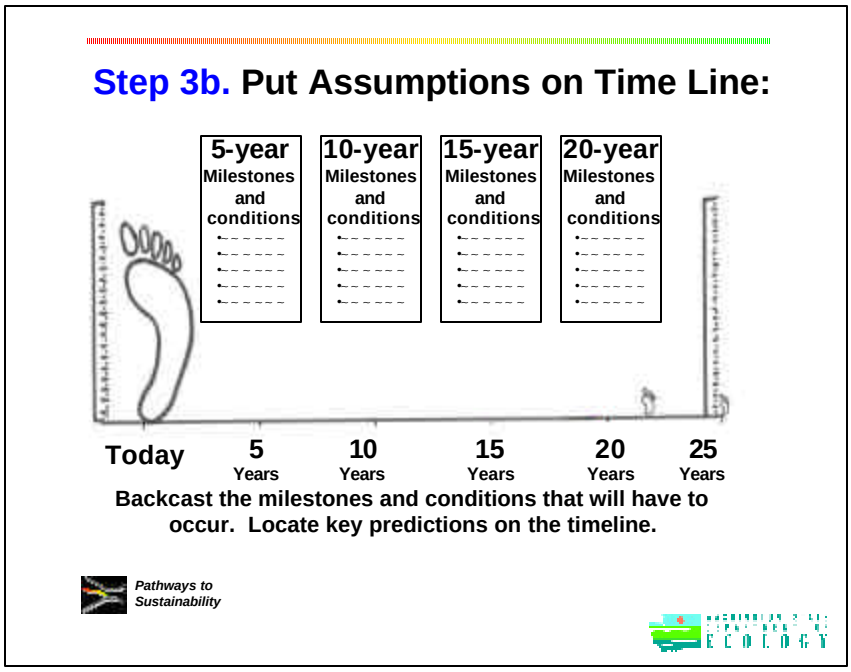
3. **Identify Strategies and Assumptions:** The next step is to outline the strategies that can accomplish these goals. The following example from the Transportation Pathway shows that these strategies are neither outlandish nor difficult to understand.

Sustainability Strategies: Transportation Example

- **Acquire high-efficiency and non-polluting fleet vehicles (depending on availability and stage of technical development).**
- **Encourage employees to use high-efficiency fleet cars over POVs through convenience, education and incentives.**
- **Promote the use of lower-impact non-automotive modes (e.g., public transport, bicycles).**
- **Invest in teleconferencing technology and better meeting records.**
- **Apply zero waste goals: zero non-biodegradable waste emitted.**
- **Reduce the need for driving through co-travel planning.**
- **Reduce the need for driving through remote monitoring.**
- **Reduce water and cleaning chemicals use in vehicle cleaning.**

Vision of the future: Once the strategies are understood, a vision of the sustainable state of each pathway can be put together, for use with the goals.

Timing assumptions: The next step is to estimate when certain technologies will come on line. For example, we estimate that larger Hybrid Electric Vehicles (using the same technology as the Toyota Prius and Honda Insight available today) will be available within five years. We estimate that the next generation of alternative fuel vehicles -- without greenhouse gas emission -- will start to become available in about twenty years.



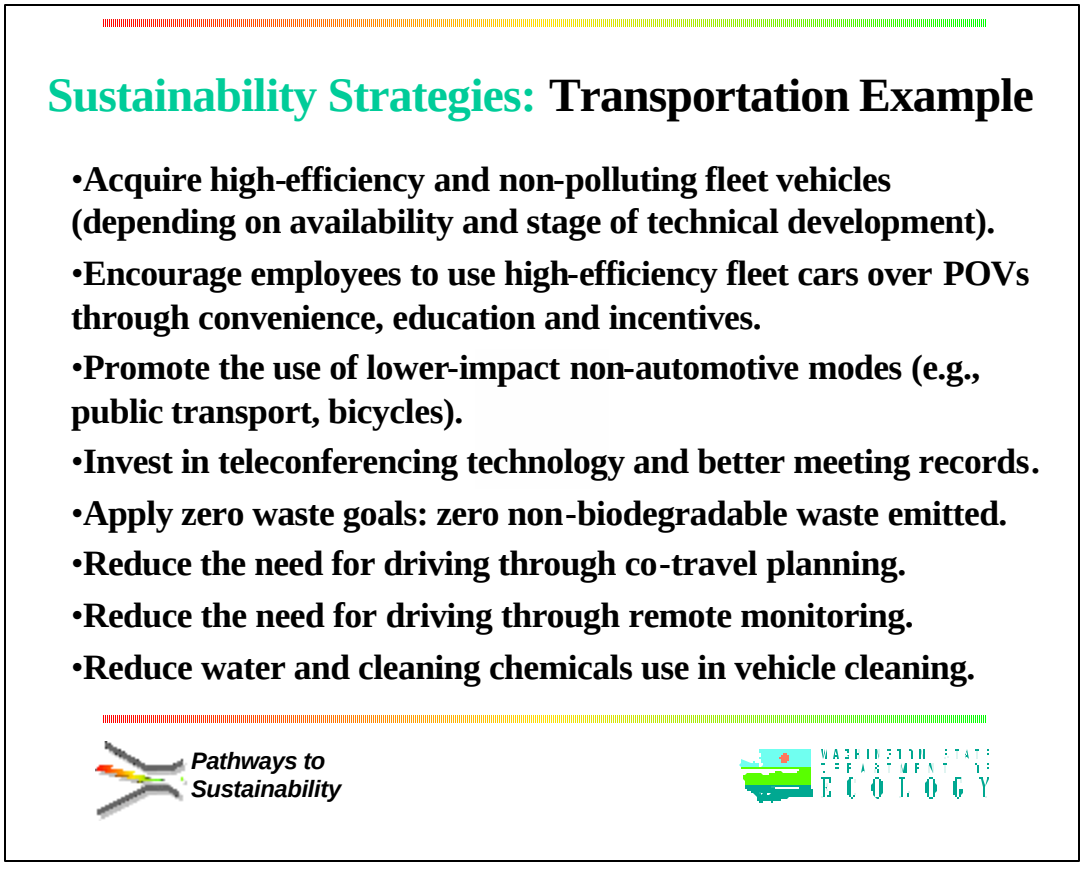
This is also the time to put major planned events on the timeline. For example, Ecology's headquarters facility will probably require re-roofing in about ten years. This information helps coordinate the scheduling of related construction projects, such as installation of rooftop solar panels. This coordinated planning and construction can also help keep costs and environmental impacts at a minimum.

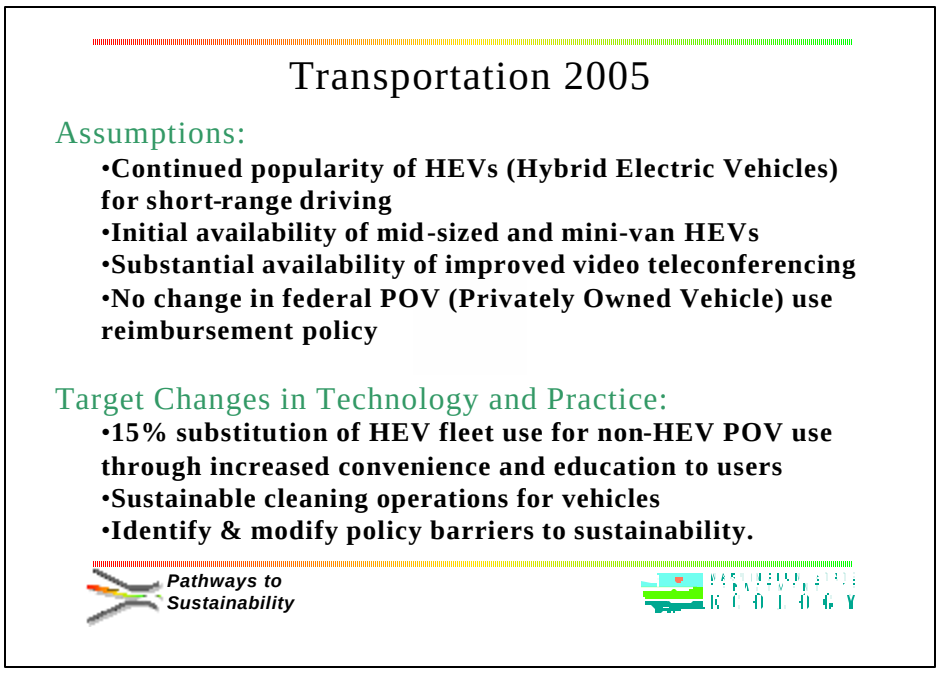
The timing estimates for the availability of new technologies are necessarily imprecise. They are based on the consultants' familiarity with the current literature on the subject. (No extensive review of the literature or future study was commissioned.) Assembling these estimates and assumptions for each of the pathways represents one of the innovations of this project, and one of the key benefits of sharing the Pathways model. One of the recommendations for this project is to maintain the Pathways technology assumptions on an open web page, for access by any other enterprise using the model. (This will allow other users of the model to save some time and cost, and allow them to contribute to update sections that are of particular interest to them.)

4. **Map Out 4 to 5 Year Sub-goals --Target Changes in Technology and Practice, Aligned With Assumptions:** The preceding work describes the kinds of changes that can achieve sustainability, and makes reasonable estimates about the availability of key technologies. With this information in place, a general timeline for implementation can be planned, in four or five year increments. (This project was prepared in five-year increments, but four year increments that aligned with electoral cycles might be more useful for public agencies.)

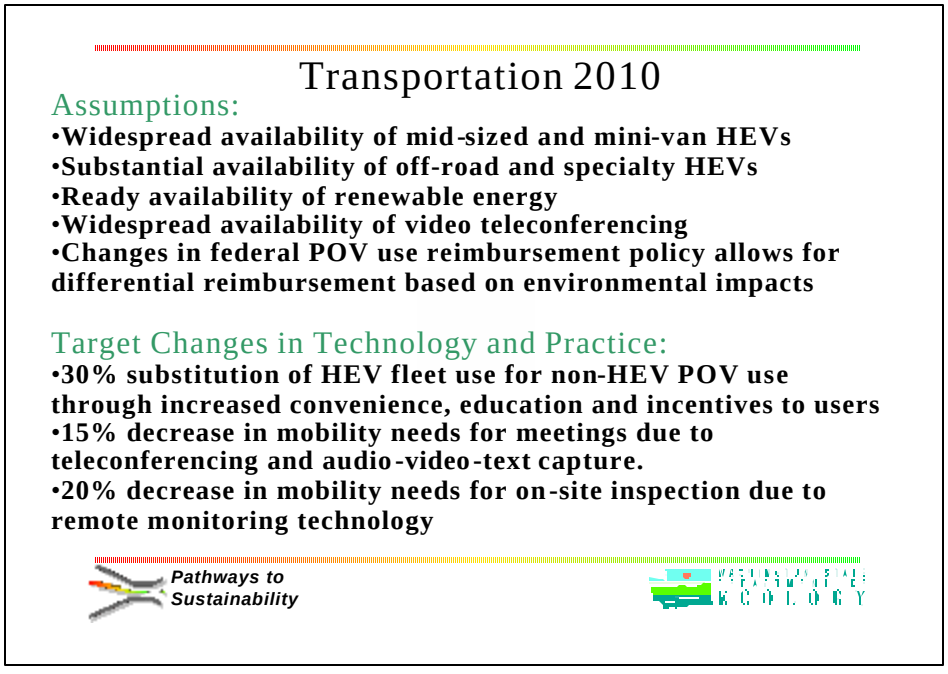
   Based on Ecology's highest impacts, this project focused on three functional pathways: Facility Infrastructure, Transportation, and Information and Communications. For each of these pathways, the report describes goals, strategies, sub-goals and assumptions in five-year increments, and suggestions for action now. Below are some examples from the Transportation pathway:

   The main strategies in making transportation impacts sustainable are to make the agency fleet less polluting (which will also save the agency money over time by reducing fuel costs) and help staff get out of lower mileage privately-owned vehicles (POVs) and into higher mileage agency fleet vehicles. (This will also save the agency money, since POV reimbursement rates are substantially greater than agency fleet costs.





The assumptions for 2010 show that we expect to see a wide range of HEVs available by then, allowing HEV technology to supplant conventional technology for most agency travel requirements. Our target for 2010 is for a 30% substitution of fleet HEV use for reimbursed POV use.



We expect video tele-conferencing technology to improve steadily, and continue to come down in cost, so that some travel for meetings can be reduced without a loss in productivity or effective-ness. In fact, we see an

Transportation 2015

Assumptions:

•Widespread availability of renewable energy at competitive prices
•Video recording and remote monitoring increases efficiency of visits, reducing the unit mobility requirements for inspections
•Convenient, cost-effective and low-impact regional transit infrastructure

Target Changes in Technology and Practice:

•50% substitution of HEV fleet use for non-HEV POV use through increased convenience, education and incentives to users
•30% decrease in meeting frequency due to efficiency from digital audio-video-text capture and video teleconferencing

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increase in effectiveness coming from improved communi-cation of meeting summaries for participants, and details for anyone who may have missed a meeting.

Transportation 2020

Assumptions:

•Some availability of cost-effective next-generation zero-impact automobile technology
•Widespread availability of renewable energy at lower prices than conventional sources

Target Changes in Technology and Practice:

•All new fleet acquisitions use next-generation zero-impact technology
•75% substitution of HEV fleet use for non-HEV POV use
•Sustainable cleaning operations for vehicles

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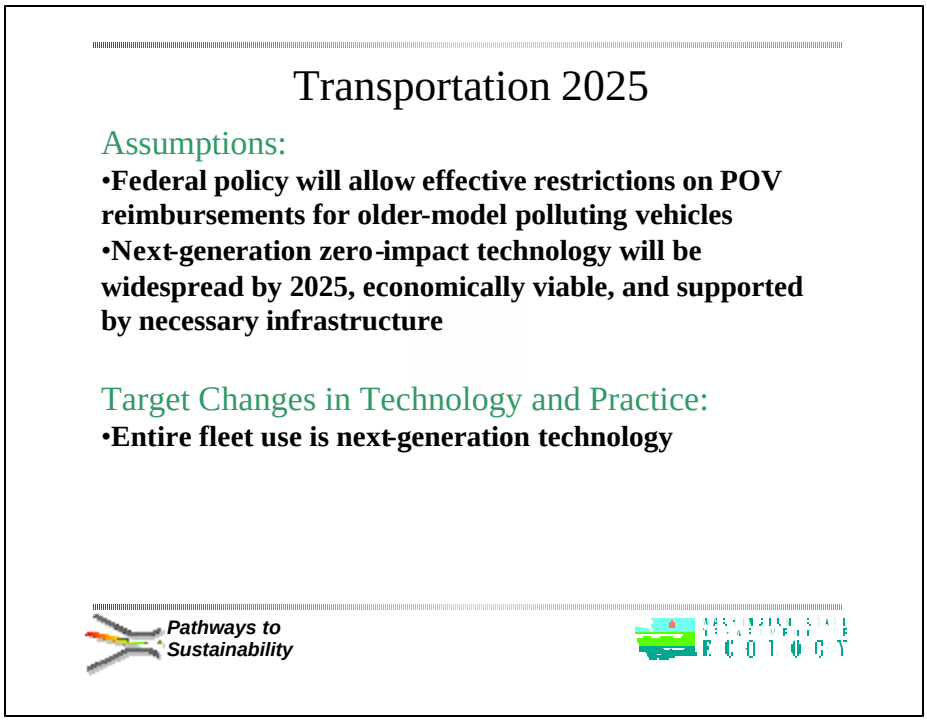
By 2015, we would expect to see a 50% substitution of HEV fleet use for less efficient POV use for agency business.

By 2020, we would expect to see this ratio increased to 75%.
By this time, we would expect to see the next generation or vehicle (whether hydrogen car, or green electricity powered electric car, or something else) available at competitive prices. So by 2020, we would be shifting new vehicle purchases to this new technology. This new technology would have to come available by 2020, for us to meet the 2025 target of the entire fleet using next-generation technology.



These four to five year benchmarks provide a useful planning framework. Using these as a guide, the enterprise can develop specific plans each budget cycle, to move steadily toward the goal, as resources allow.

5. Implementation:

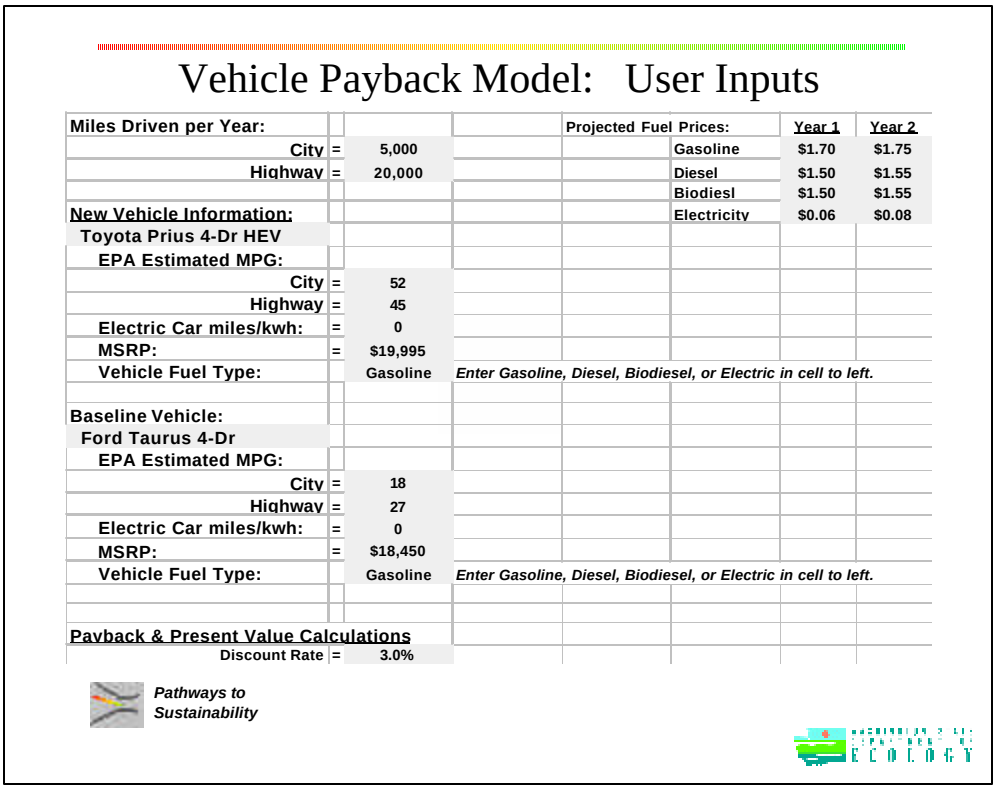
Implementation begins with understanding. The first steps in implementation are education and training, to ensure that everyone involved understands why change is needed, understands the scale of change that is needed, and understands the viability of this long-term approach to change.

Implementation requires commitment. The next step requires resolve. The enterprise needs to make the general commitment to become sustainable in 25 years.

The Pathways to Sustainability green planning model can be adopted in whole or in part to support the efforts of the enterprise to become sustainable. The Pathways model is not an engineered solution, it is only a framework to help plan and organize change. Within the four to five year sub-goals, specific plans and budgets will have to be prepared. In each case, cost savings from avoided future costs will have to be presented prominently, wherever they apply, along with environmental benefits.

Wherever practical, implementation planning should be conducted through existing work teams. With good leadership, education, and communication, existing work groups can factor sustainability planning goals into their on-going operations planning. The Pathways framework is designed to give them the tools they need to do that successfully. Some additional support will be useful to help build confidence in what is not yet a mainstream approach.

Payback Analysis Tools: In order to help work groups analyze alternative investment strategies, and support budget proposals for investments in sustainability, the Pathways project includes payback tools. Three working spreadsheets have been prepared by one of the consulting economists, to help staff working on specific proposals calculate future avoided costs of fuel and energy use. Part of the theory of the "funnel" is that we can expect (non-green) energy costs and other natural-resource-based costs to rise as we experience shortages (approach the wall). We do not expect that all environmental costs will necessarily be adequately reflected in these rising resource costs. But we do expect that turning to a sustainable way of doing business requires investments that reduce future environmental risks , and these will tend to reduce financial risks from rising prices of natural resource-based goods and services. Since the investments cost money and require effort to make changes, the corresponding financial as



Vehicle Payback Model: User Inputs

Miles Driven per Year:				Projected Fuel Prices:		Year 1	Year 2
City	=	5,000			Gasoline	$1.70	$1.75
Highway	=	20,000			Diesel	$1.50	$1.55
					Biodiesl	$1.50	$1.55
New Vehicle Information:					Electricity	$0.06	$0.08
Toyota Prius 4-Dr HEV							
EPA Estimated MPG:							
City	=	52					
Highway	=	45					
Electric Car miles/kwh:	=	0					
MSRP:	=	$19,995					
Vehicle Fuel Type:		Gasoline	*Enter Gasoline, Diesel, Biodiesel, or Electric in cell to left.*				
Baseline Vehicle:							
Ford Taurus 4-Dr							
EPA Estimated MPG:							
City	=	18					
Highway	=	27					
Electric Car miles/kwh:	=	0					
MSRP:	=	$18,450					
Vehicle Fuel Type:		Gasoline	*Enter Gasoline, Diesel, Biodiesel, or Electric in cell to left.*				
Payback & Present Value Calculations							
Discount Rate	=	3.0%					

Pathways to Sustainability

Vehicle Payback Model: Money Payback Results

Payback & Present Value Calculations					
Discount Rate =	3.0%				
New vs. Baseline Price Differenti =	$1,545	amount to be paid back through fuel savings			
Projected Fuel Cost Savings:	Year 1	Year 2	Year 3	Year 4	
Not Discounted	$812	$836	$860	$884	
Discounted	$789	$788	$787	$786	
Cumulative Not Discounted	$812	$1,649	$2,509	$3,393	
Payback Period (years)	1.9				
Net Present Value	$1,605				

Pathways to Sustainability

well as environmental benefits need to be communicated to support this turning toward sustainability. These payback models incorporate environmental benefits into the payback analysis, thus connecting financial and environmental criteria in the analysis of investment strategies for sustainability.

Vehicle Payback Model: Monetary + Environmental Payback

Environmental Impacts	Emissions Reductions	Estimated Environmental Cost Savings Low Estimate		High Estimate
Annual Atmospheric Emissions	(thousand lbs)	(annual $)		(annual $)
Particulates (Total)	0.0	$37		$189
Nitrogen Oxides	0.0	$16		$180
Hydrocarbons (non CH4)	0.1	$17		$261
Sulfur Oxides	0.0	$0		$15
Carbon Monoxide	0.3	$2		$139
CO2 (biomass)	0.0	$0		$0
CO2 (non biomass)	10.0	$2		$122
Ammonia	0.0	$0		$0
Lead	0.0	$0		$0
Methane	0.0	$0		$0
Hydrochloric acid	0.0	$0		$0
		$74		$906

Payback & Present Value Calculations Including Environmental Cost Savings				
Projected Total Cost Savings: (Fuel+Average Environmental)	Year 1	Year 2	Year 3	Year 4
Not Discounted	$1,303	$1,326	$1,350	$1,374
Discounted	$1,265	$1,250	$1,236	$1,221
Cumulative Not Discounted	$1,303	$2,629	$3,979	$5,354
Payback Period (years)	1.2			
Net Present Value	$3,427			

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Communicating Results (The Case for an Open System): Wherever possible, the results of using this model should be open for sharing with other users and potential users. In the private sector, this is not always possible, since competitive advantage can be compromised by too much disclosure of investment strategies. But in the public sector, this information can be shared, and can save the public money as a result.

Keeping an open model in the public sector also can have substantial benefits for the private sector. Small businesses and households do not generally have the expertise or resources to hire consultants to work through the kind of planning information provided through the Pathways project. They must rely on public sources of information to make their plans and choices.

Keeping this long-range planning data public has another benefit for the private sector, as well as the larger society and economy. Predicting when public agencies plan to shift to new technologies can help private entrepreneurs develop and produce these technologies. In this sense, private enterprise likes predictability. And in facilitating predictability the public sector helps break the chicken and egg cycle that prevents production of new technologies until the private sector is sure that there will be a demand, while at the same time new demand does not happen until the technology is widely and economically available.

Next Steps: At Ecology, our primary internal focus will be on implementation of the three pathways to sustainability for our three major impacts areas:

- Facility Infrastructure
- Transportation
- Information and Communications

As resources permit, we would like to develop Pathways models for our next tier of impacts:

- Water
- Food
- Landscape maintenance

This next group is also expected to be interest to a wide audience, including other public agencies, a variety of businesses, and, notably, households. Preparing these Pathways materials for use by households and small businesses will require additional resources to make the materials easier to understand and use.

Externally, as resources permit, we would like to begin to make these materials available to sister state agencies, local governments, and other public organizations.

Conclusion:

What the Pathways to Sustainability Project Accomplishes:

- **The cognitive belief that sustainability in 25 years is attainable.** This, in itself, is a significant accomplishment. It is very difficult to get the best work from work teams if they don't believe the result is possible.
- **A planning framework Ecology can use now, and refine in the future where necessary.** This 25-year planning framework is very useful. It is an appropriate time horizon for the amount of work that needs to be done, yet it offers near-term targets that will accomplish the goal.
- **This framework is good for building internal cooperation.** This framework is useful for mapping the changes the agency intends to make. This helps reduce internal conflict over competing projects, and creates the conditions for cooperation to achieve the near-term goals first, then move on to the others.
- **A framework that lends itself to budget proposal development in a cost-cutting climate:** By emphasizing and quantifying the future costs associated with energy and natural-resource-related requirements, this framework can help make planning and budgeting for sustainability successful.
- **An open approach to sustainability planning:** This is a sharable green planning model. It is readily adaptable by other state agencies, in Washington, Oregon, and

elsewhere. Local governments, large and small businesses, and even households can also use it.

For further information, please consult Ecology's Sustainability Web Site at www.ecy.wa.gov/sustainability **or consult a member of the project team:**

PowerPoint slides for public and not-for-profit use are available from John Erickson at mailto:jeri461@ecy.wa.gov .

Tools for Green Planning